The high-p_T trigger detector of VHMPID

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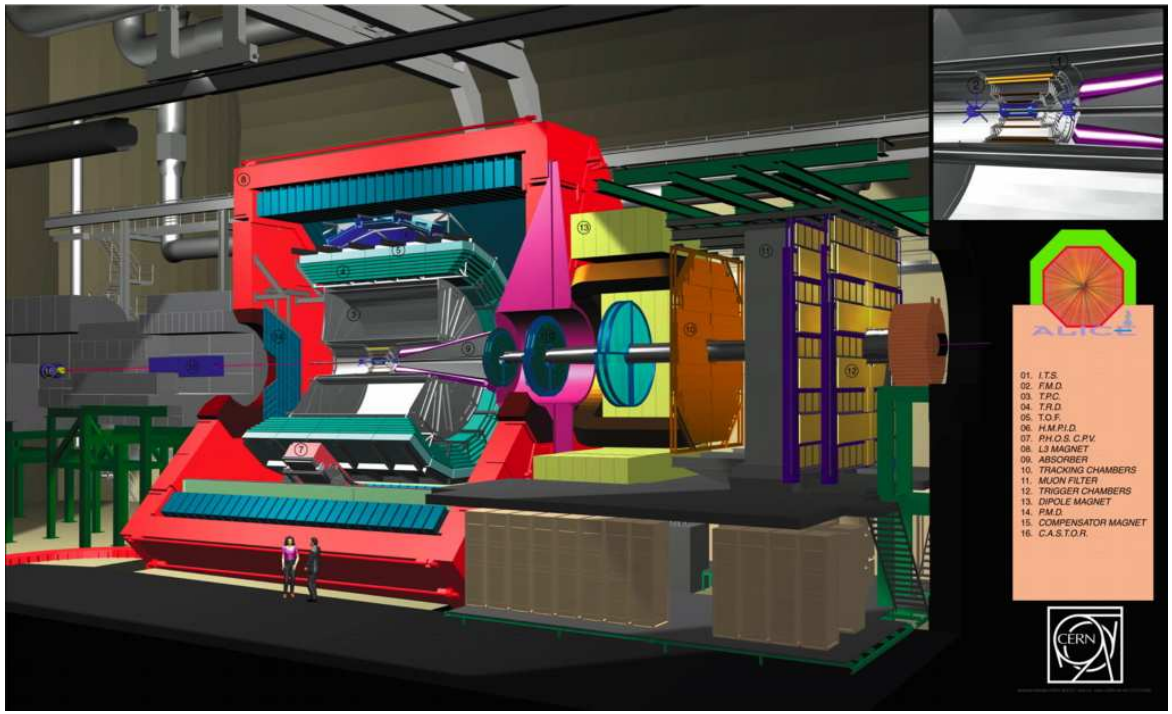

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Motivations

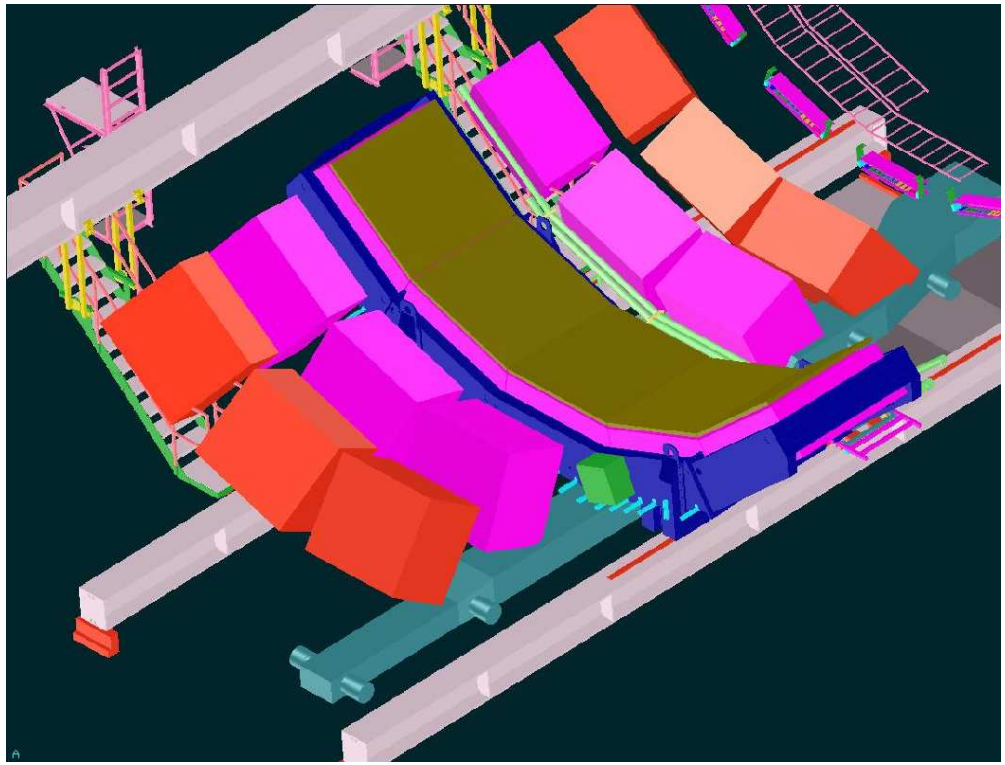
Because of some theoretical considerations and exp. measurements the specification of particle ID's in higher p_T region seems to be more important than earlier...

- event by event particle identification above 5 GeV
- where will the pQCD region begin? (proton-pion anomaly)
- study of fragmentation processes
  - in matter modifications of FF (pp vs. PbPb)
  - multihadron fragmentation functions (baryon-antibaryon corr.)
- near-side and away-side correlations (with PHOS and EMCAL)
- jet energy loss (volume/surface), flavour dependence
- reconstruction of D and B mesons, Λ barions in higher p_T regions

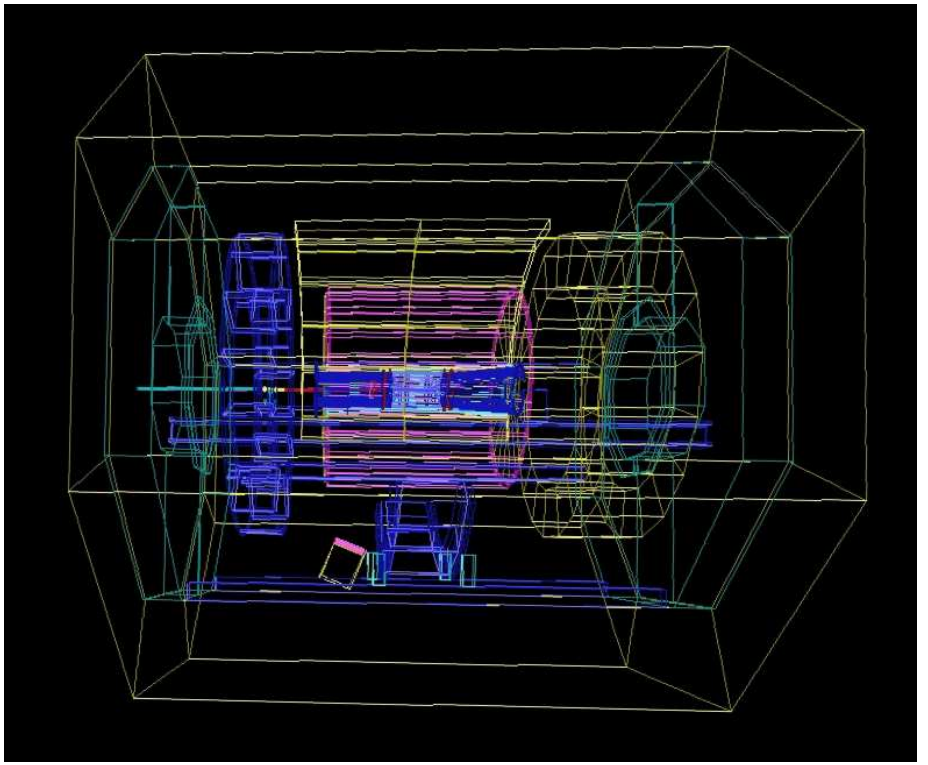
To increase the statistics of high p_T events in the recorded data sample we need a high p_T trigger!

Motivations

There is some space available for VHMPID and its Trigger Detector opposite side of EMCAL, near PHOS: 12 modul with 140*90*120 cm would cover about the 0.3% of the full 4π acceptance and about 6% of central rapidity unit

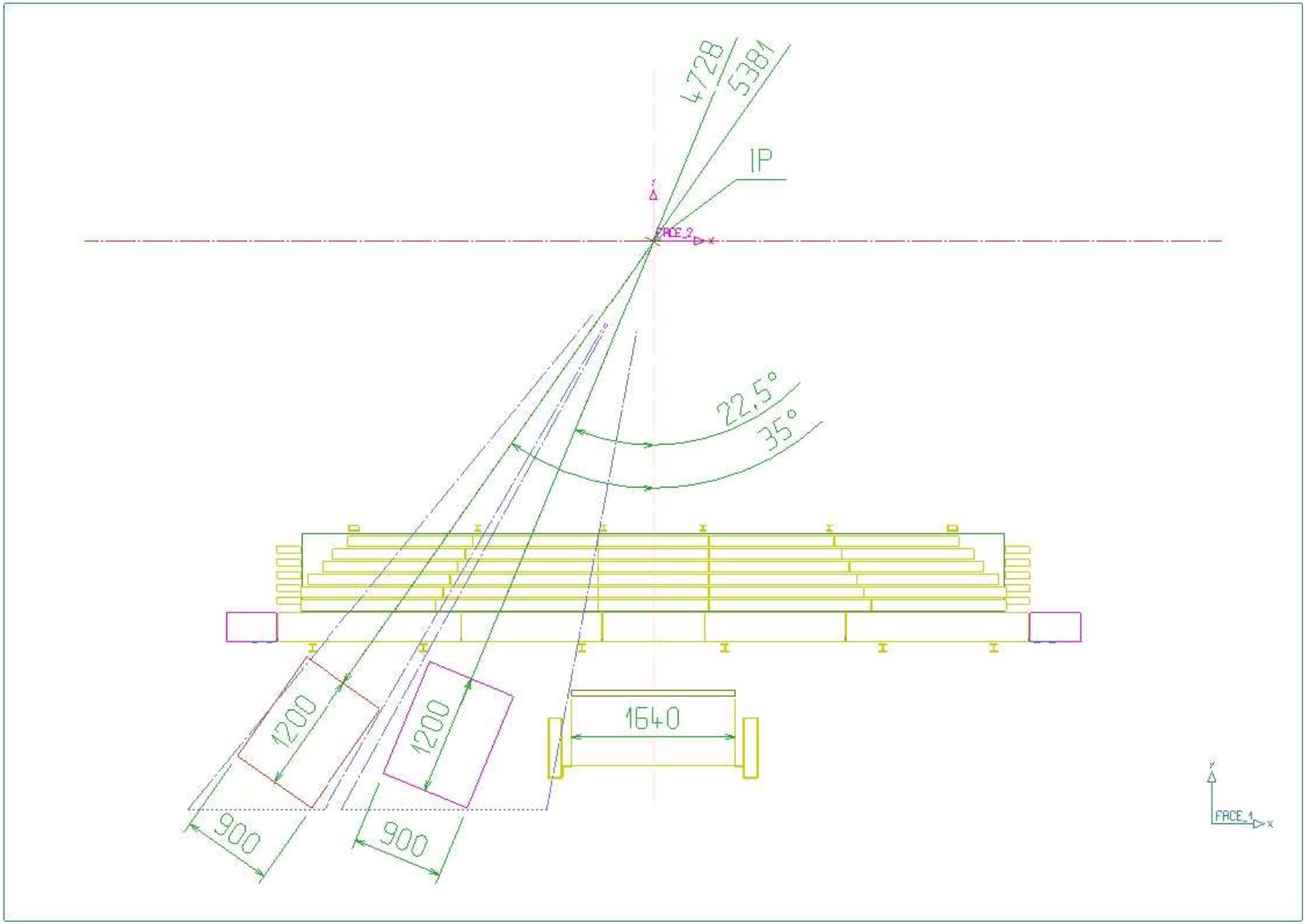


possible position of 12 modul



ALIROOT simulation of 1 modul (left-inner-middle)

Motivations



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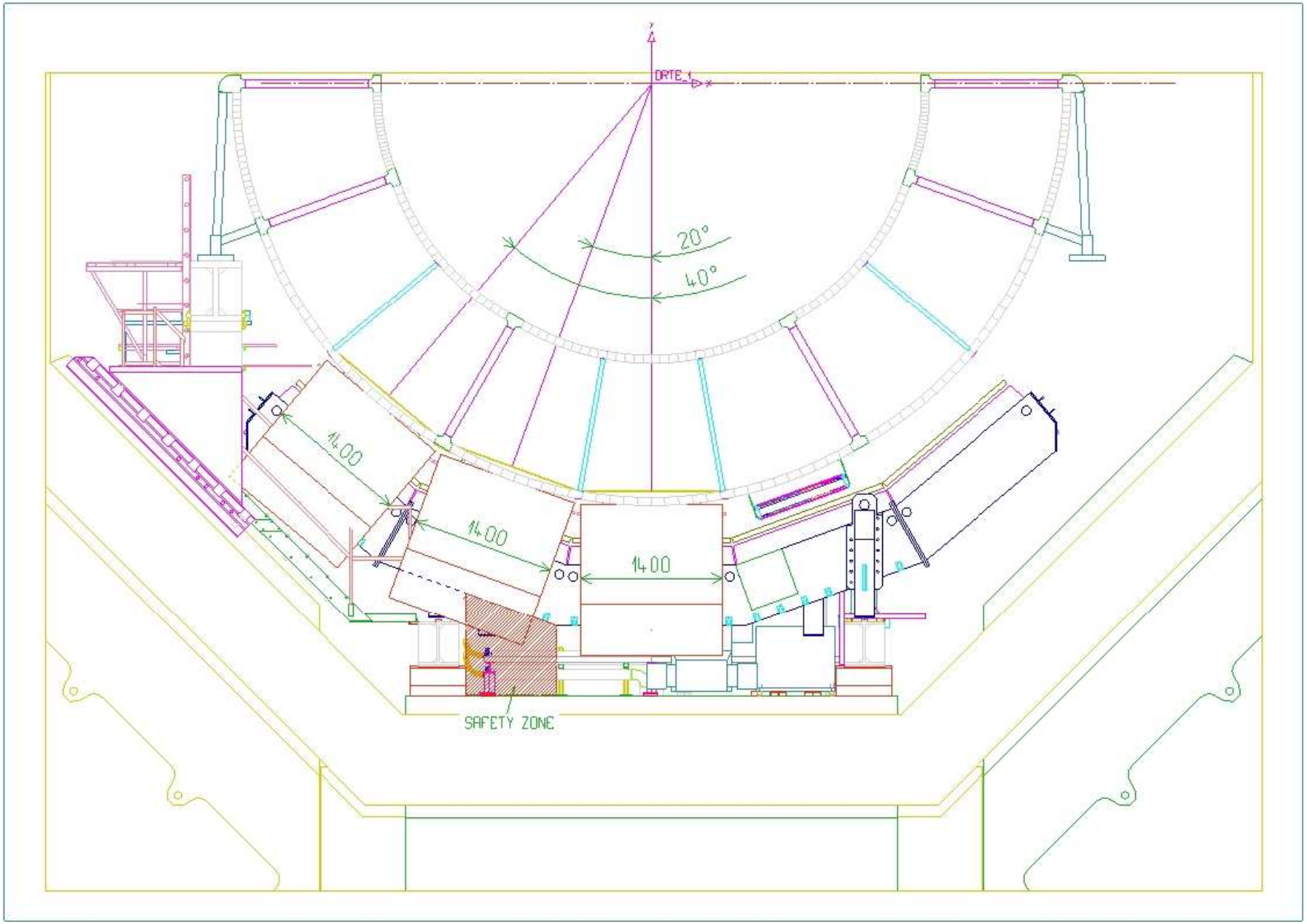
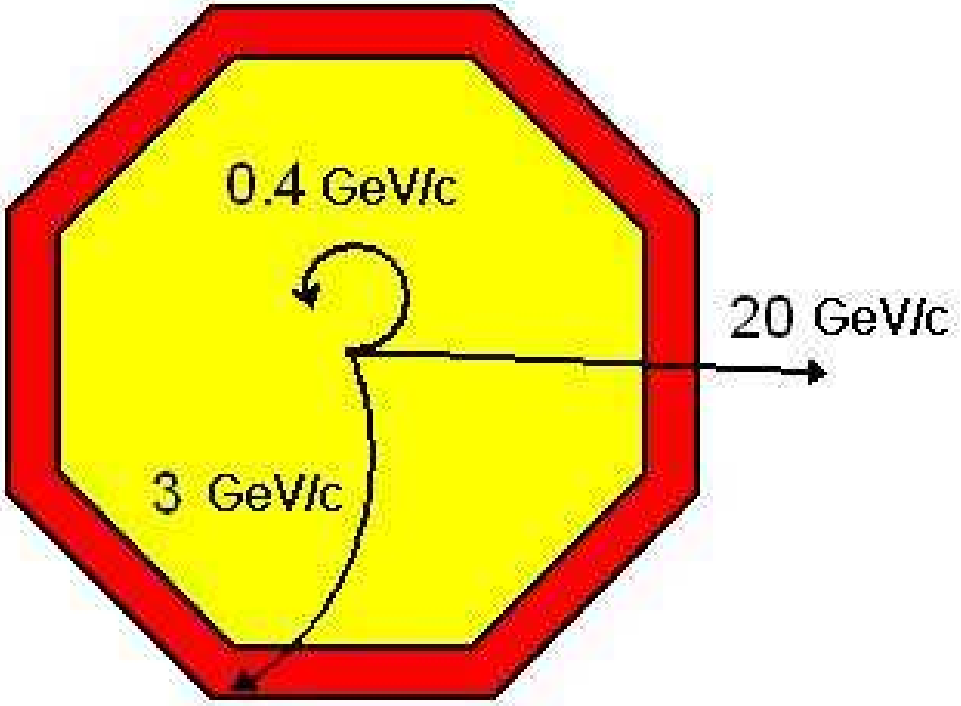
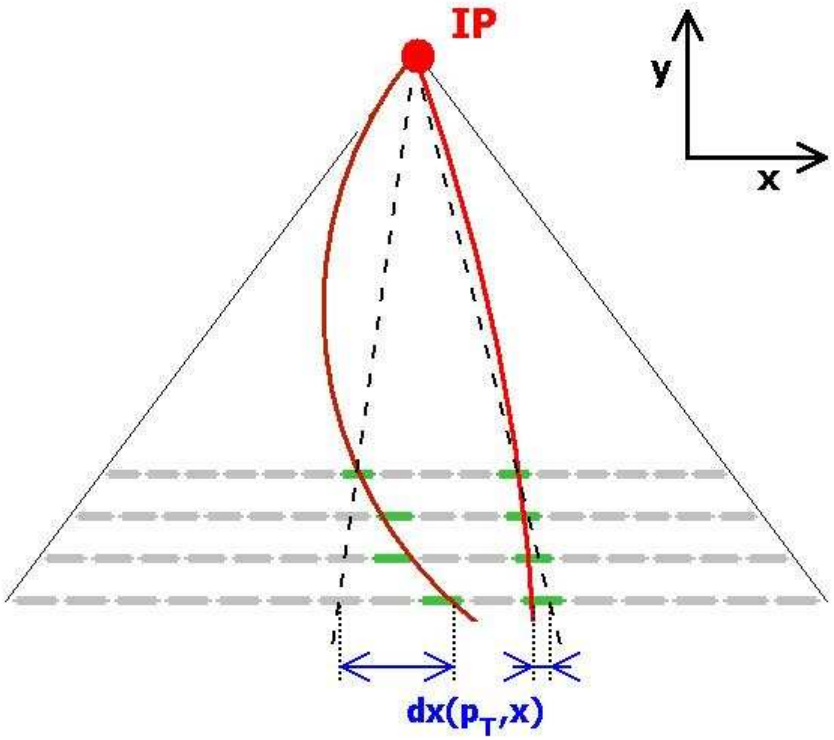


Equipment Development

Fast, compact high p_T trigger detector is needed! $\longrightarrow$ We use the magnetic field!



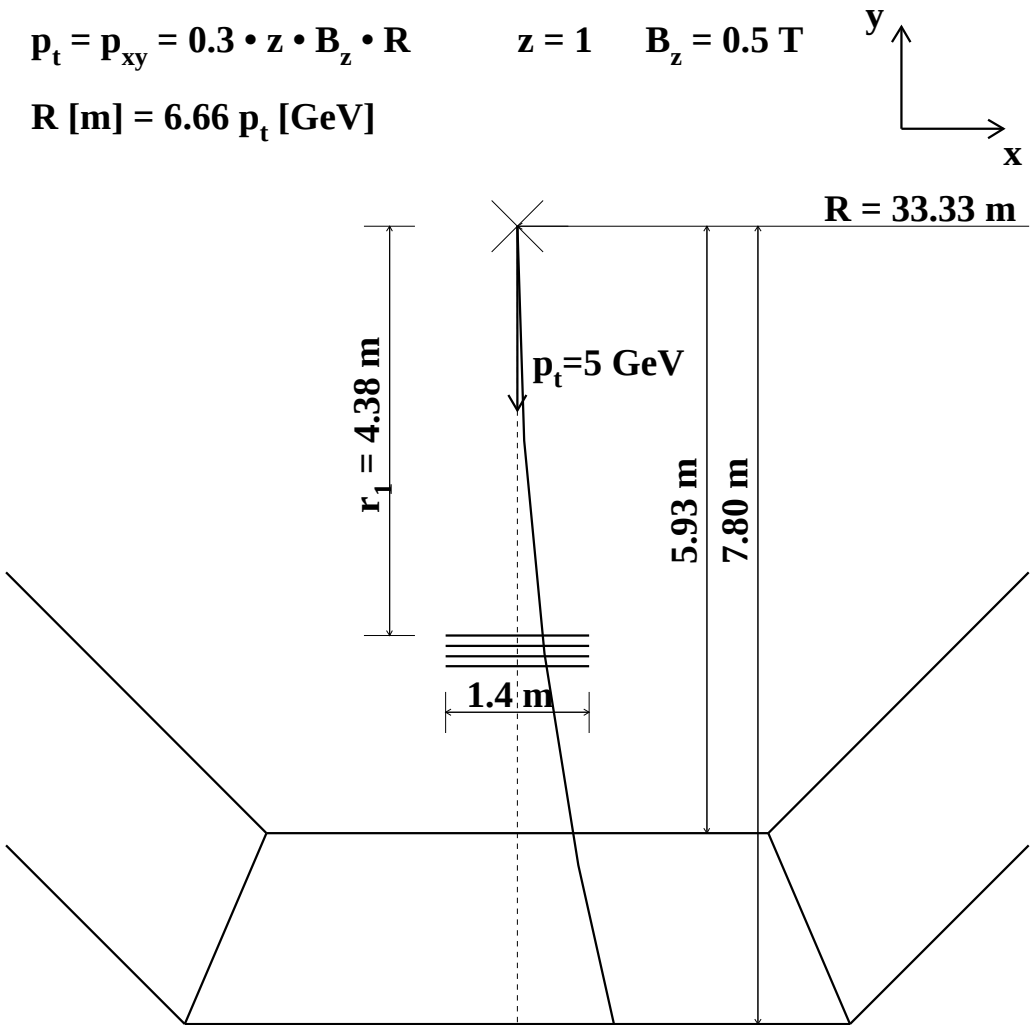


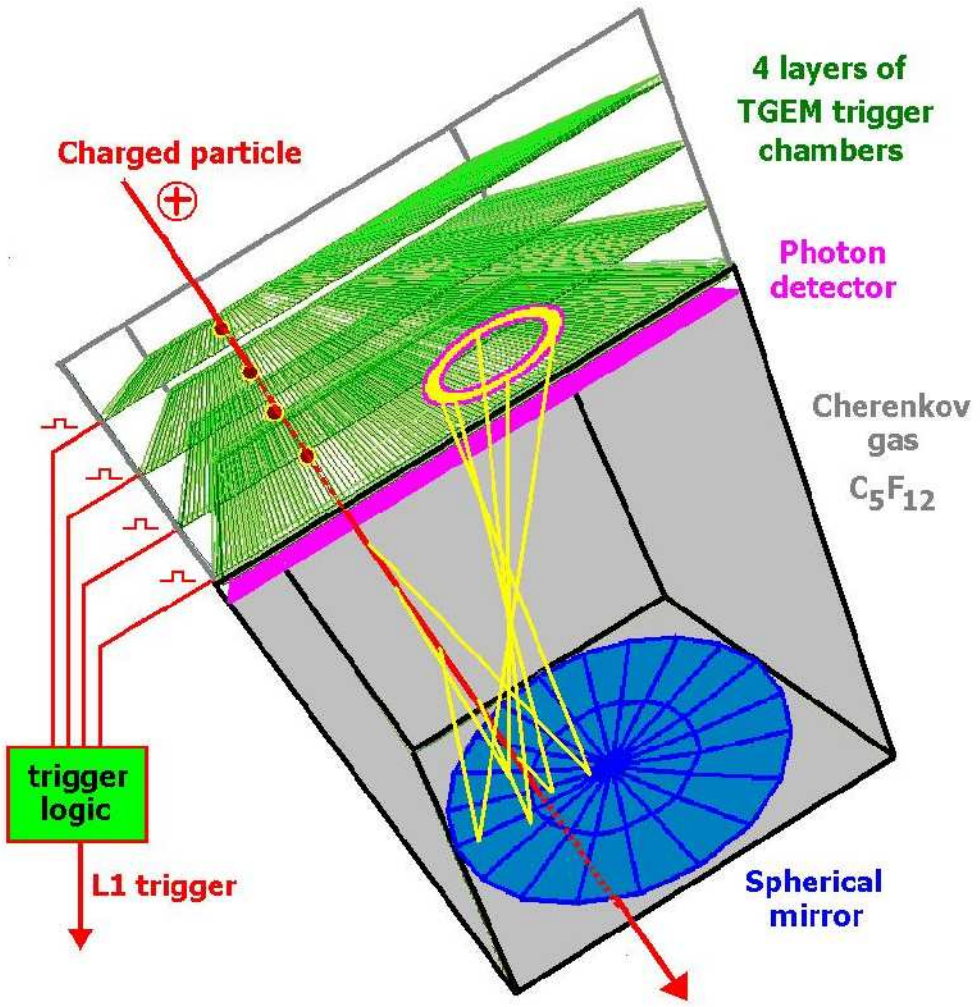
Charged high p_T particle track is close to a straight line.
The angle of incidence is close to 0°. We use a high resolution multilayer strip detector to determine this angle.
Small deviation from the radial line causes hits under each other.
A fast electronic logic could trigger these events.

4 layer of strip detector seems to be enough about 4.5 m from the interaction point

$p_t = p_{xy} = 0.3 \cdot z \cdot B_z \cdot R$ $\quad z = 1 \quad B_z = 0.5$ T

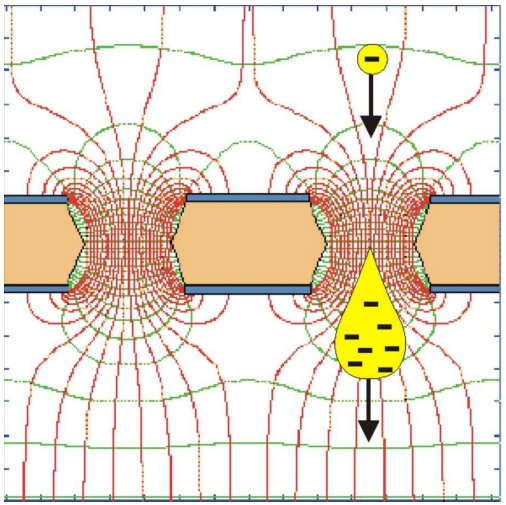
R [m] = 6.66 p_t [GeV]



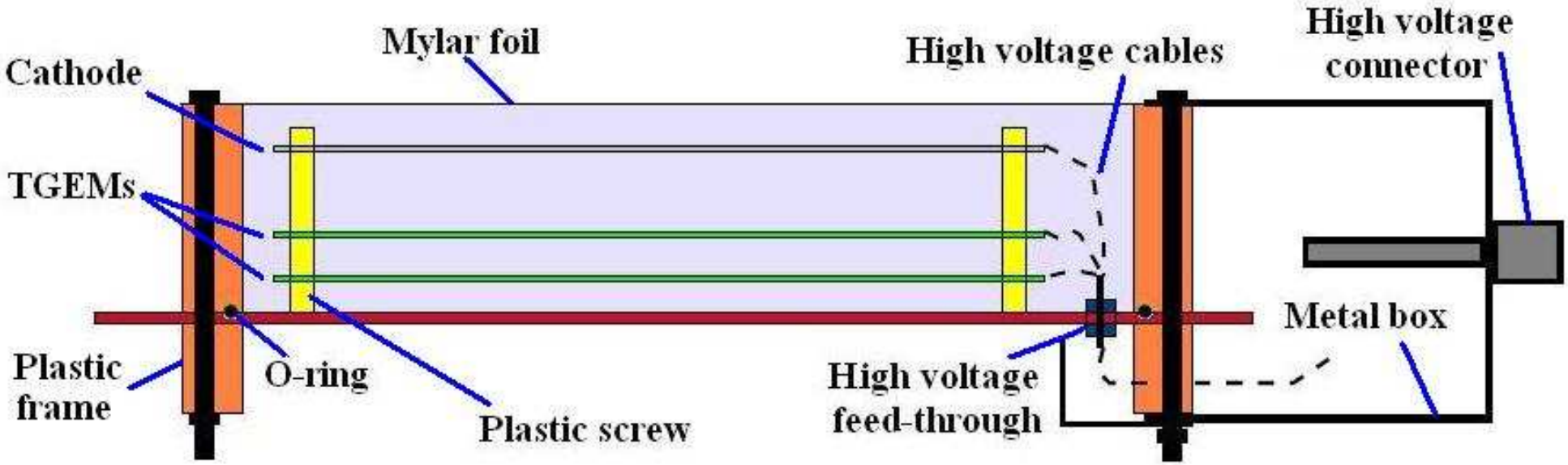


20 cm is needed for Trigger Detector; 100 cm remains for the VHMPID gas modul

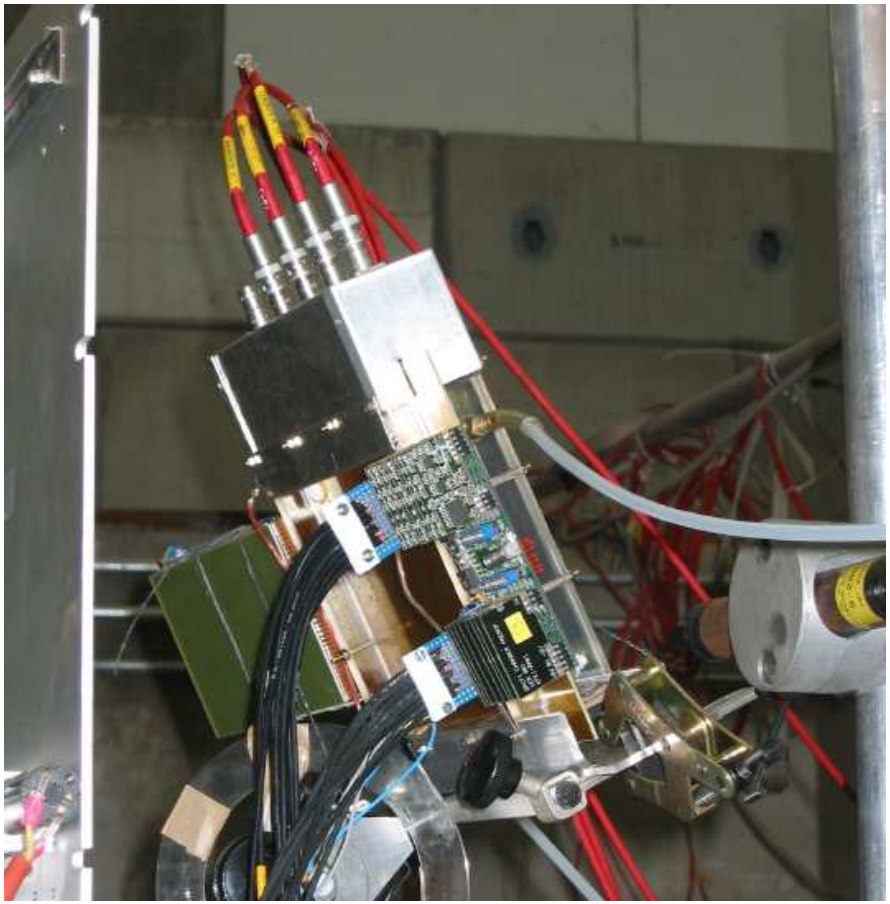
We would use RETGEMs
(Resistive Thick Gas Electron Multiplier)
to detect the the high p_T particle
(quick, robust, cheap technology)

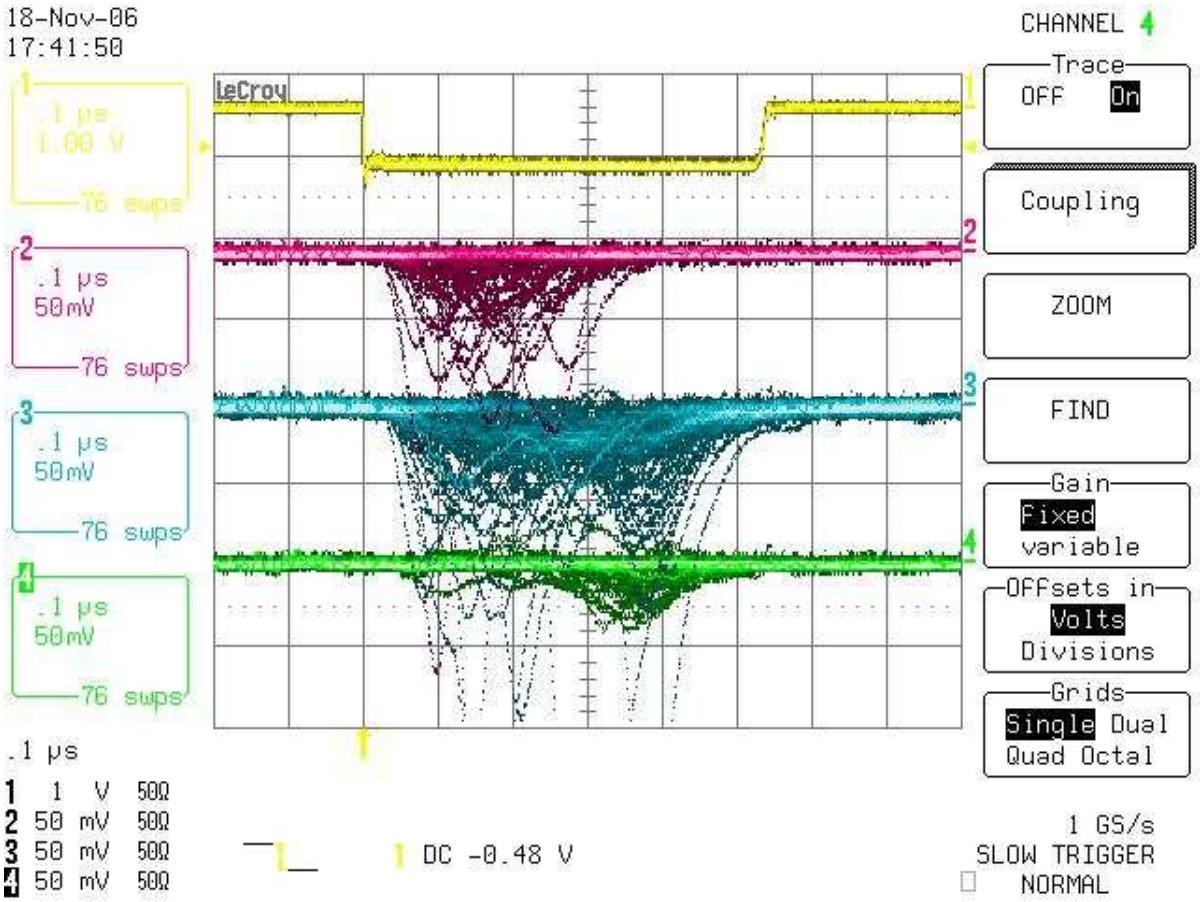


To study the technology and feasibility
we built a test chamber with 10*10 cm sensitive surface
(2 TGEM; 1000 V voltage, Ar/CO_2 90:10)



Chamber was succesfully tested in 2006 november with PS 6 GeV proton test beam!



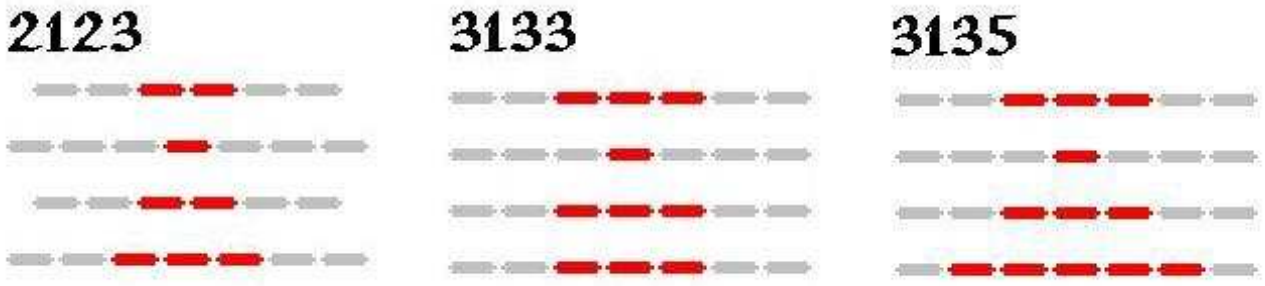


Our plan is to build one full-size modul prototype!

The main goal of simulation is to optimize the padwidth and geometry

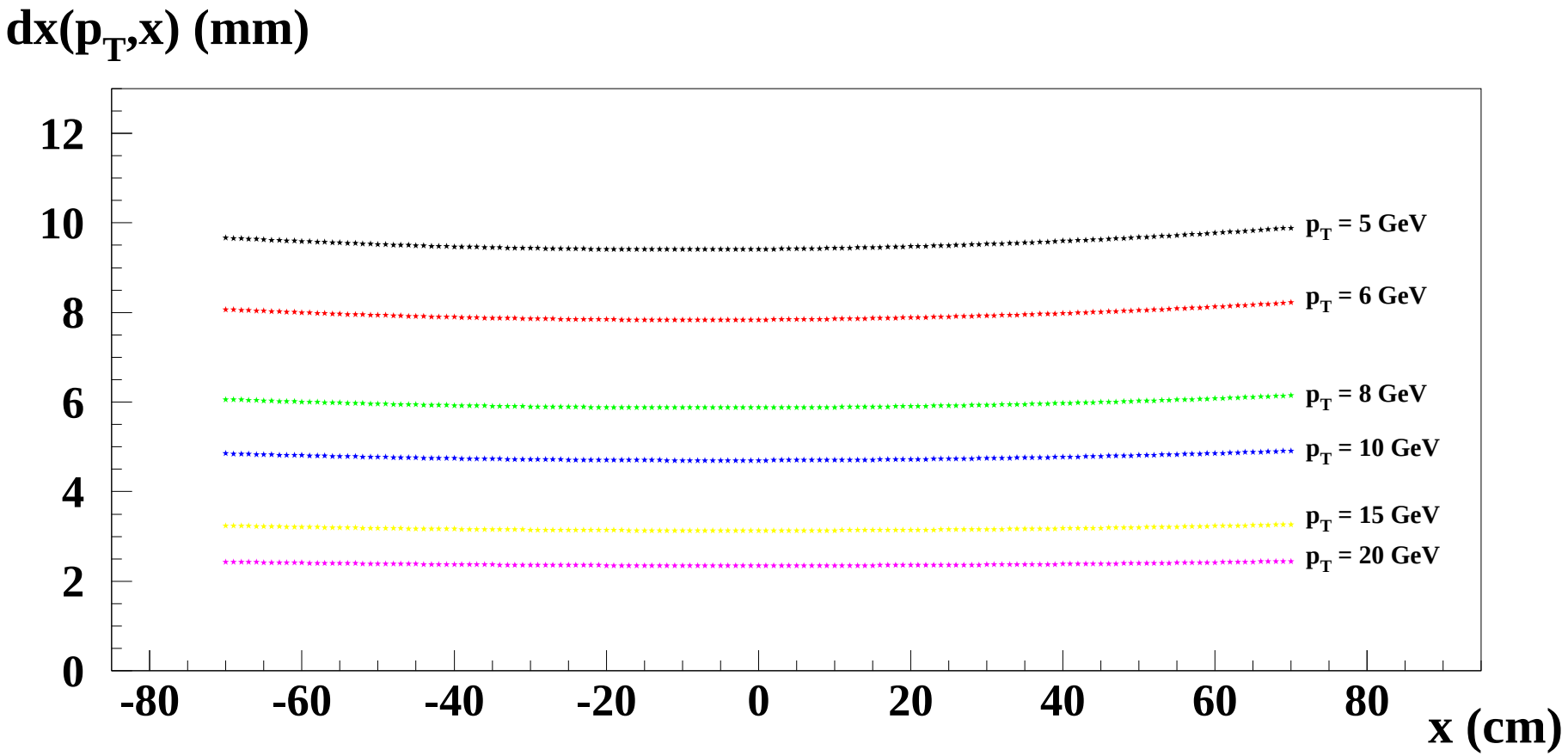
- to minimize the total surface of pads used by the trigger logic
  (in order to decrease the low p_T background)
- to minimize the number of logical decisions
  (in order to decrease the time of trigger decision)

the most simpliest versions of logical trigger decisions:
(logical .or. among the pads of one layer; logical .and. among the 4 layer)



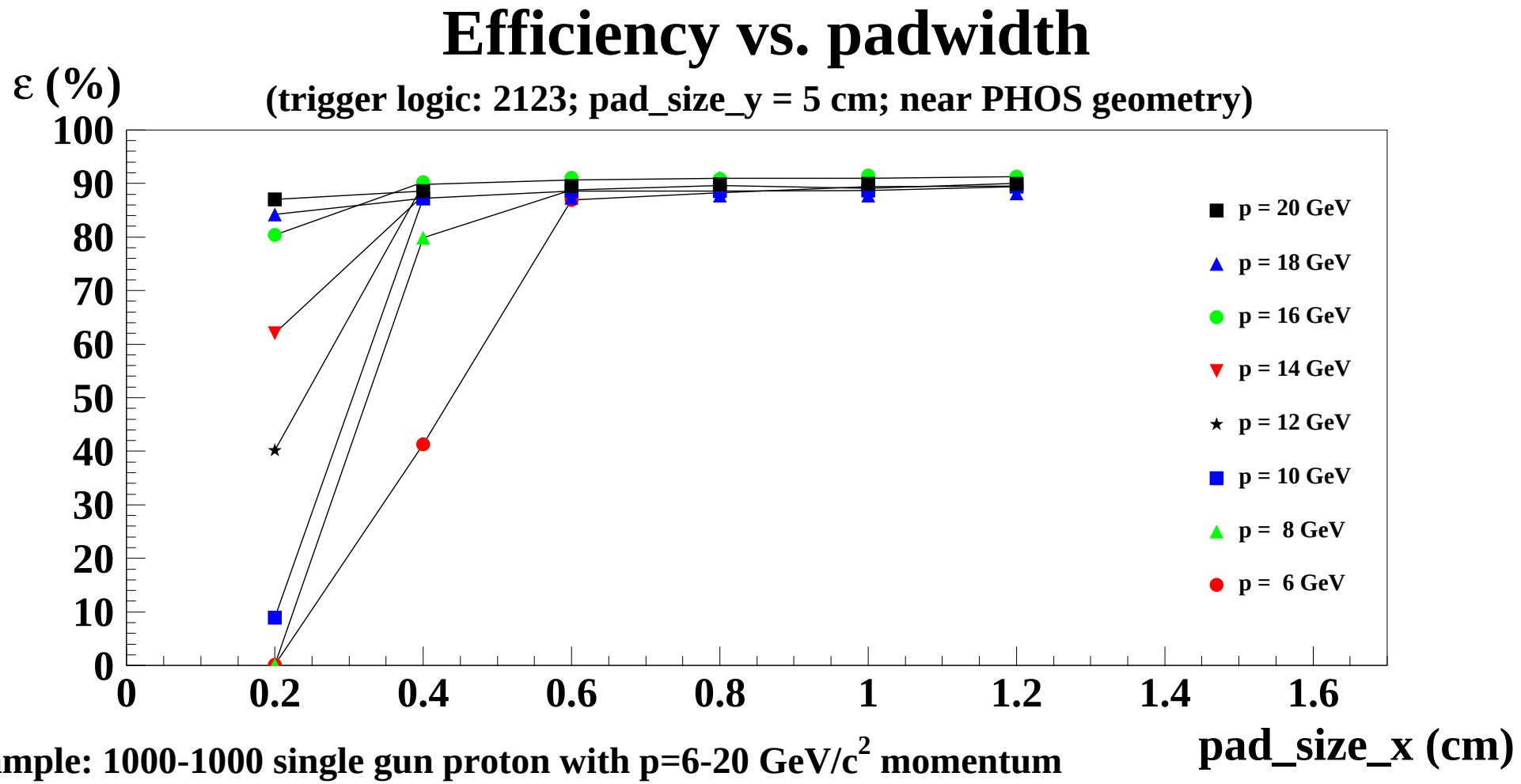
Simulation Results

The deviation from the extrapolated 4th layer position of the high p_T particle



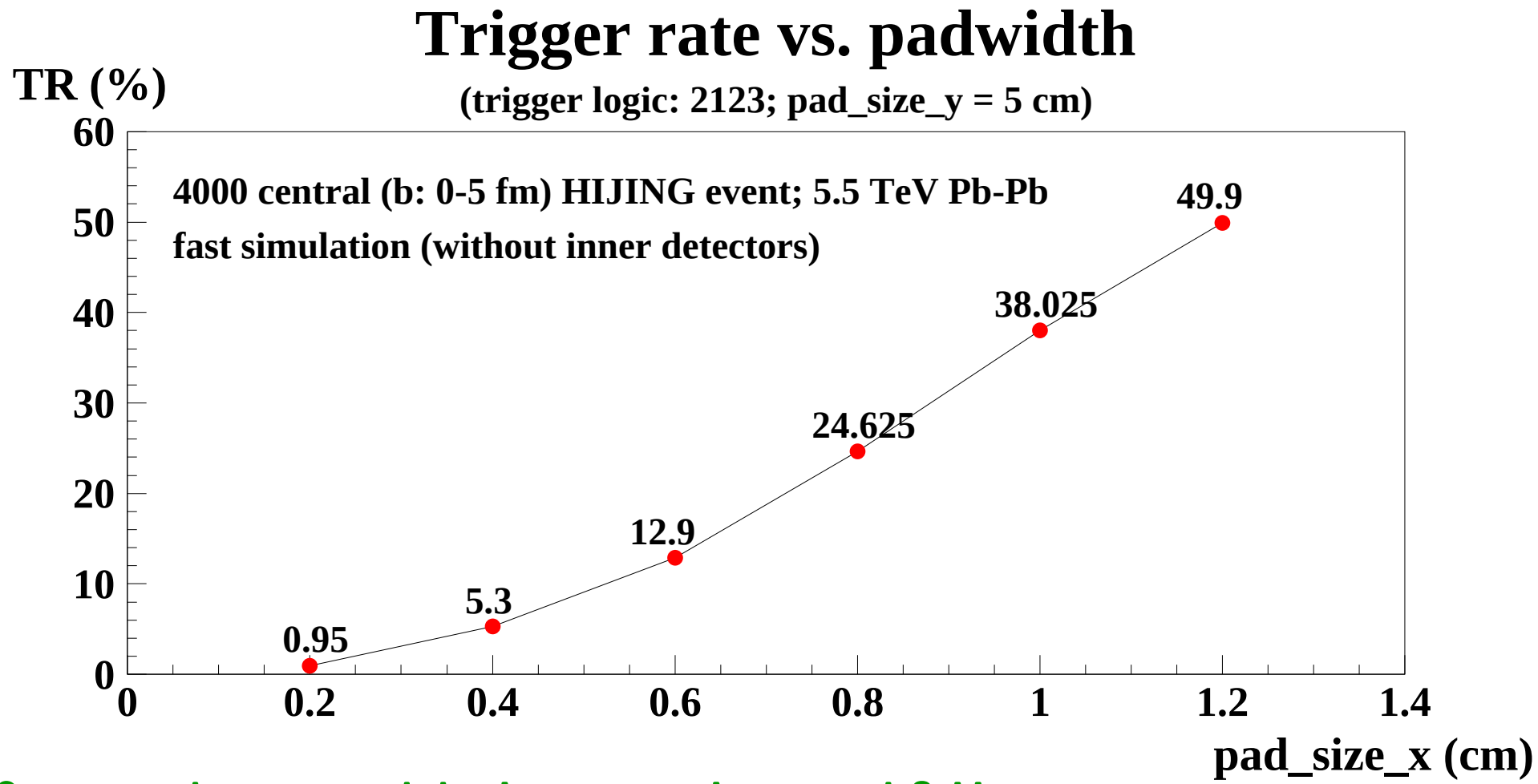
What indicate the padwidth for a certain p_T and trigger logic

The trigger efficiencies for certain p_T as the function of padwidth



With the used parameters and geometry it saturates around 4-6 mm

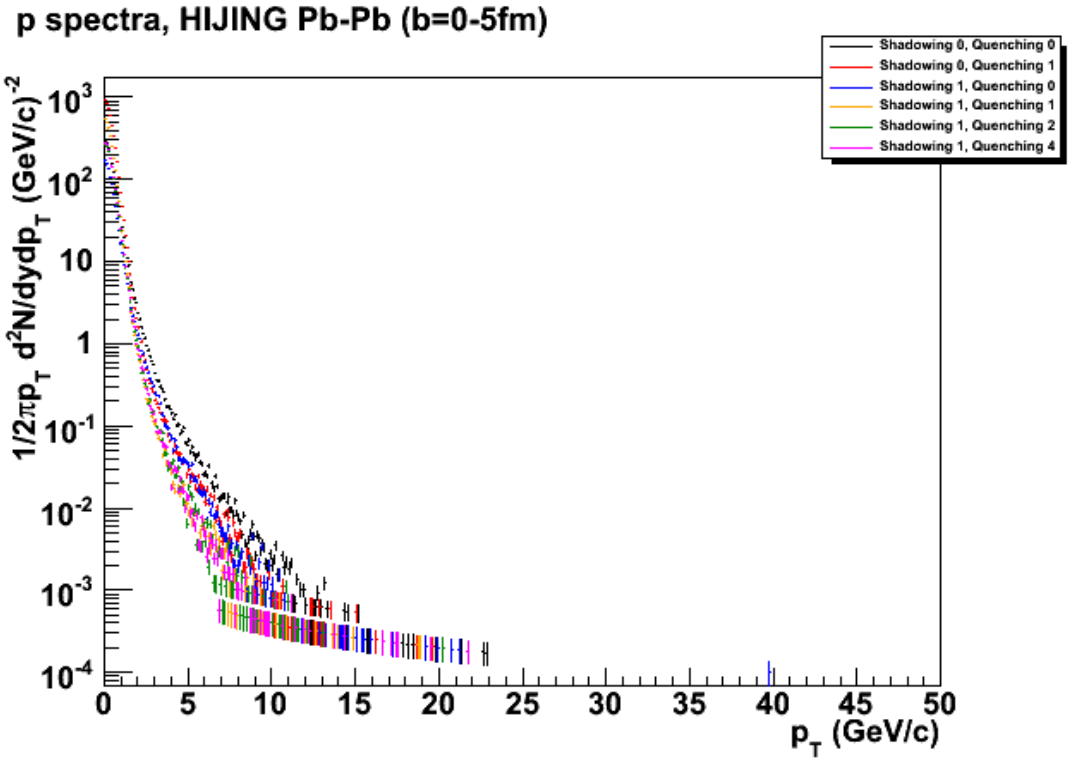
Trigger rate of central PbPb events (no jet quenching, but shadowing was used)



With 2 mm pads one modul trigger rate is around 8 Hz.
(12 modul could compensate the jet quenching effect)

5.5 TeV PbPb collisions at LHC:

8000 minimum bias events in 1 second
800 central events in 1 second (10% centrality)
20 events would be recorded in 1 second
$\longrightarrow$ a factor of 40 of high p_T content could be reached in the recorded data sample!



a 8 Hz high p_T trigger
would start to work around 8-9 GeV
what is the same p_T where
the VHMPID starts to see kaons!

Summary

- interesting physics above $p_T > 5$ GeV/c
- if ALICE wants to study this region high p_T trigger and particle identification are needed
- VHMPID and its High p_T Trigger Detector could work

Thank you for your attention!